IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	)	
	)	
DAVID J. BAKER ET AL.	)	Group Art Unit 1791
	)	
Serial No. 10/712,904	)	Confirmation No.: 9434
	)	
Filed: November 13, 2003	)	Examiner Mark Halpern
	)	
For: EXHAUST POSTIONED AT THE DOWNSTREAM END OF A GLASS MELTING FURNACE	)	Attorney Docket 25090A

Mail Stop: AF
Commissioner for Patents, P.O. Box 1450
Alexandria, VA 22313-1450
Attention: Board of Appeals and Interferences

BRIEF ON APPEAL

Honorable Sir:

This Appeal is taken from the Examiner's Final Rejection of Claims 1-18, 27-32 and 34-37 in the above-identified application. The Notice of Appeal was timely filed on April 25, 2008. Please charge Deposit Account No. 50-0568 in the amount of $510.00 to cover the fee pursuant to 37 C.F.R. 41.20(b)(2).

Respectfully submitted,

Margaret S. Millikin
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Date 8/4/08

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Table of Contents

I. Real Party in Interest

The real party of interest is Owens Corning Intellectual Capital, LLC, the assignee of record, which is a corporation organized and existing by virtue of the laws of the State of Delaware, having its principal place of business in Toledo, Ohio.

II. Related Appeals and Interferences

There are no other appeals or interferences that are known to Appellants, the Appellants' representative, or assignee which will directly affect, be directly affected by, or have a bearing on the Board's decision in this appeal.

III. Status of Claims

Claims 1-18, 27-32 and 34-37 are pending in the application, which have been finally rejected by the Examiner, and are involved in this appeal.

IV. Status of Amendments

There have been no amendments to the application since the last Office Action dated January 25, 2008.

V. Summary of Claimed Subject Matter

A. One embodiment of the invention is a glass-melting furnace as claimed in independent claim 1, as shown in the specification at least at page 7 lines 16-18, and page 9, line 11, and at least in Figures 1 and 2, where the glass-melting furnace includes:

at least one burner positioned for supplying at least a majority of the heat to the glass-forming material at the upstream end; and

an exhaust disposed within the downstream end for allowing exhaust gases to provide additional heat to the melting glass-forming material, and for allowing at least some air-entrained glass-forming materials to settle back into the melting glass as exhaust gases travel from the upstream end to the downstream end.

B. Additional novel elements of the furnace claimed in claim 1:

In certain embodiments, as shown in the specification at least at page 7, lines 8-9, and at least in Figures 1-6, and claimed in claim 2, at least one burner is mounted through the roof of the glass-melting furnace.

In certain embodiments, as shown in the specification at least at page 7, lines 4-5, and at least in Figures 1-6, claimed in claim 3, the at least one burner is a plurality of burners.

In certain embodiments, as shown in the specification at least at page 9, line 11, and at least in Figures 1-6, and claimed in claim 4, more than 50 percent of the burners are positioned upstream of the exhaust.

In certain embodiments, as shown in the specification at least at page 7, line 1 to page 13, line 21, and at least in Figures 1-6, and claimed in claim 5, all of the burners are positioned upstream of the exhaust.

In certain embodiments, as shown in the specification at least at page 8, lines 10-11, and at least in Figures 1-6, and claimed in claim 6, the exhaust is an exhaust stack.

In certain embodiments, as shown in the specification at least at page 8, line 5, and at least in Figures 1-6, and claimed in claim 7, the exhaust is a plurality of exhaust stacks.

In certain embodiments, as shown in the specification at least at page 12, lines 2-17, and at least in Figure 6, and claimed in claim 8, the exhaust is disposed at a discharge end wall of the glass-melting furnace.

In certain embodiments, as shown in the specification at least at page 8, line 8, page 9, line 15 to page 11, line 5, and at least in Figures 4 and 5, and claimed in claim 9, the exhaust is disposed at a sidewall of the glass-melting furnace.

In certain embodiments, as shown in the specification at least at page 7, line 1 to page 13, line 21, and at least in Figures 1-6, and claimed in claim 10, the at least one burner is a plurality of burners mounted through the roof of the glass-melting furnace, all of the burners are positioned upstream of the exhaust outlets, and the exhaust comprises at least two exhaust outlets.

In certain embodiments, as shown in the specification at least at page 8, line15, and at least in Figures 1-6, and claimed in claim 11, the exhaust outlets are a plurality of exhaust stacks.

In certain embodiments, as shown in the specification at least at page 7, lines 21-22, and at least in Figure 4, and claimed in claim 34, further at least one downstream burner supplying heat to the downstream fining end.

In certain embodiments, as shown in the specification at least at page 7, lines 8-9, and at least in Figures 1-6, and claimed in claim 35, in which the downstream burner is mounted in the roof.

In certain embodiments, as shown in the specification at least at page 7, lines 24-25, and at least in Figures 1-6, and claimed in claim 36, in which at least one upstream burner is mounted at an angle of up to about 20 degrees to the vertical.

In certain embodiments, as shown in the specification at least at page 7, line 26 to page 8, line 2, and at least in Figures 1-6, and claimed in claim 37, in which the downstream burner is mounted at an angle of up to about 20 degrees to the vertical.

C. Another embodiment of the invention is a glass-melting furnace as claimed in independent claim 12, as shown in the specification at least at page 8, lines 18-21, and at least in Figures 2 and 4, where the glass-melting furnace includes:

an exhaust disposed within the glass-melting furnace, the exhaust having a centerline that is positioned at least about 70 percent of the distance from the charge end wall of the glass-melting furnace to the discharge end wall of the glass-melting furnace for exhausting combustion gases in the glass-melting furnace.

D. Additional novel elements of the furnace claimed in claim 12:

In certain embodiments, as shown in the specification at least at page 8, line 22, page 10, line 6, and at least in Figures 2 and 4, and claimed in claim 13, in which the exhaust centerline is positioned at least about 80 percent of the distance from the charge end wall of the glass-melting furnace to the discharge end wall of the glass-melting furnace.

In certain embodiments, as shown in the specification at least at page 9, line 15 to page 11, line 5, and at least in Figures 4 and 5, and claimed in claim 14, the glass-melting furnace comprises two sidewalls and two exhausts, each exhaust being separated laterally from the sidewalls.

E. Another embodiment of the invention, is a glass-melting furnace as claimed in independent claim 15, and shown in the specification at least at page 7 lines 16-18, and at least in Figures 1 and 2, where the glass-melting furnace has

the upstream melting end and the downstream fining end being configured to allow unimpeded flowing and blending of melting glass-forming material.

F. Additional novel elements of the furnace claimed in claim 15:

In certain embodiments, as shown in the specification at least at page 12, lines 2-17, and at least in Figure 6, and claimed in claim 16, the exhaust is disposed at the discharge end wall.

In certain embodiments, as shown in the specification at least at page 8, lines 10-11, and at least in Figures 1-5, and claimed in claim 17, the exhaust comprises an exhaust stack.

In certain embodiments, as shown in the specification at least at page 8, line 5, and at least in Figures 1-6, and claimed in claim 18, the exhaust comprises a plurality of exhaust stacks.

G. Another embodiment of the invention, is a glass-melting furnace as claimed in independent claim 27, and shown in the specification at page 8, lines 3-4, and in Figure 2, where the glass-melting furnace includes:

at least one exhaust at the downstream end of the glass-melting furnace for exhausting combustion gases only from the at least one exhaust.

H. Additional novel elements of the furnace claimed in claim 27:

In certain embodiments, as shown in the specification at least at page 8, lines 18-21, page 10, line 3, and at least in Figures 2 and 4, and claimed in claim 28, in which the at least one exhaust has a centerline that is positioned at least about 70 percent of the distance from the upstream end to the downstream end of the glass-melting furnace.

I. Another embodiment of the invention, is a glass-melting furnace as claimed in independent claim 29, and shown in the specification at page 8 lines 24-25, and in Figures 1 and 2, where the glass-melting furnace includes:

one or more exhausts disposed only at the downstream end of the glass-melting furnace for exhausting combustion gases in the furnace only from the downstream end of the glass-melting furnace;

the exhaust disposed for allowing: i) exhaust gases to provide additional heat to the melting glass-forming material, and ii) at least some air-entrained glass-forming materials to settle back into the melting glass as exhaust gases travel from the upstream end to the downstream end.

J. Additional novel elements of the furnace claimed in claim 29:

In certain embodiments, as shown in the specification at least at page 8, lines 18-21, page 10, line 3, and at least in Figures 2 and 4, and claimed in claim 30, in which the one or more exhausts have centerlines that are positioned at least about 70 percent of the distance from the upstream end to the downstream end of the glass-melting furnace.

K. Another embodiment of the invention, is a glass-melting furnace as claimed in independent claim 31, and shown in the specification at least at page 11, line 24, and at least in Figure 2, where the glass-melting furnace includes:

at least one burner supplying heat to the glass-forming material in the first half of the glass-melting furnace; and

at least one exhaust disposed within the second half of the glass-melting furnace and no exhaust disposed within the first half of the glass-melting furnace for exhausting combustion gases only from the second half of the glass-melting furnace.

L. Additional novel elements of the furnace claimed in claim 31:

In certain embodiments, as shown in the specification at least at page 8, lines 18-21, page 10, line 3, and at least in Figures 2 and 4, and claimed in claim 32, wherein the first half defines a charge end and the second half defines a discharge end, the at least one exhaust having a centerline that is positioned at least about 70 percent of the distance from the upstream end to the downstream end of the glass-melting furnace.

VI. Grounds of Rejection to be Reviewed on Appeal

Grounds of rejection are set forth in the Office Action dated January 25, 2008, and the Advisory Action dated April 10, 2008, as:

A. Whether claims 1, 3-8, 12-13, 15-17 and 27-32 are patentable under 35 U.S.C. §102(b);

B. Whether claims 2, 10-11 and 18 are also patentable under 35 U.S.C. §103(a);

C. Whether claims 9 and 14 are also patentable under 35 U.S.C. §103(a); and

D. Whether Claims 34-37 are also patentable under 35 U.S.C. §103(a).

VII. Arguments

A. Rejection of claims 1, 3-8, 12-13, 15-17 and 27-32 under 35 USC §102(b)

Claims 1, 3-8, 12-13, 15-17 and 27-32 stand rejected as being anticipated by the Shepherd reference. Applicants submit that claims 1, 3-8, 12-13, 15-17 and 27-32 are patentable over the Shepherd reference.

A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. *Verdegaal Bros. v Union Oil Co. of California,* 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). The identical invention

must be shown in as complete detail as is contained in the claim. *Richardson v Suzuki Motor Co.*, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989). The elements must be arranged as required by the Applicants' claim. *In re Bond,* 15 USPQ2d 1566 (Fed. Cir. 1990).

The present invention is directed to a glass melting furnace where the exhaust is positioned at a downstream end of the furnace.

In particular, independent claim 1 specifically recites "...an exhaust disposed within the downstream end of the glass-melting furnace for exhausting combustion gases only from the downstream end of the glass-melting furnace...".

Independent claim 12 recites "...the exhaust having a centerline that is positioned at least about 70 percent of the distance from the charge end wall of the glass-melting furnace...".

Independent claim 15 recites "...an exhaust disposed within the glass-melting furnace at the downstream end of the glass-melting furnace for exhausting combustion gases in the glass-melting furnace only from the downstream end...".

Independent claim 27 recites "...at least one exhaust at the downstream end of the glass-melting furnace for exhausting combustion gases only from the at least one exhaust...".

Independent claim 29 recites "...one or more exhausts disposed only at the downstream end of the glass-melting furnace...".

Independent claim 31 recites "...no exhaust disposed within the first half of the glass-melting furnace...".

The particular advantage of the present invention is clearly shown in Figure 7 where a typical prior art glass-melting furnace heat profile 200 is compared with a heat profile 220 for the glass-melting furnace according to the invention. The temperature throughout the first 75 percent of the furnace from the charge end wall is well above that of a conventional furnace, and there is no relatively cold portion at the upstream end of the furnace, in contrast to the conventional furnace heat pattern 200. Further, the relatively low temperature seen at the zero percent distance of the prior art heat profile (graph 200) is not seen with the heat profile (graph 220) for the glass-melting furnace according to the invention. The comparatively higher temperature at the zero percent distance indicates that more efficient energy utilization and glass batch melting achieved with the glass-melting furnace according to the invention.

It is to be understood that, if the furnace is operated with a slightly greater energy input than was the case for the furnace represented by graph 220, the temperature profile will

be more elevated at the charge end of the furnace, as shown at graph line 222. Likewise, if the furnace is operated with a slightly less energy input than was the case for the furnace represented by graph line 220, the temperature profile will be slightly lower at the charge end of the furnace, as shown at graph line 224.

In contrast, the Shepherd furnace describes a glass melting furnace having exhaust gas ports 32 and 33 that are positioned at the *upstream* end only of the furnace, as clearly shown in Figures 1 and 2 therein. In particular, the Shepherd reference, at least at column 3, line 20 through column 4, line 10, is dedicated to explaining the importance of the position of the exhaust ports 32 and 33 at the "charge" or front end of the furnace.

There is no teaching or suggestion in the Shepherd reference of positioning an exhaust at a downstream end, near the fining end of the furnace.

With respect to the Examiner's statement in the Office Action, at page 3, that "...[E]xhaust is a plurality of exhaust stacks as shown in Fig. 1.", the Applicants respectfully submit that there are no "plurality of exhaust stacks." Applicants respectfully note that the Shepherd Fig. 1 contains a plurality of downstream orifices 37a-37d, from which molten glass is drawn.

It is submitted that the Shepherd *upstream exhaust* furnace cannot solve the problem found in glass-melting furnaces where the velocity of the exhaust gases causes an undesired entrainment of the combustion fumes (released from the decomposition of the glass-forming raw materials) with the gases. Rather, the present invention provides a novel solution for glass-melting furnaces by having gases exhausted only from the exhaust at the downstream end of the glass-melting furnace. The Shepherd reference was not aware of these problems facing the glass-melting industry and did not address, let alone purport to solve, this problem found in glass making furnaces.

A person having ordinary skill in the art would have no apparent reason to reconfigure the Shepherd elements, as proposed by the Examiner, in order to achieve the novel glass-melting furnace being claimed herein.

Therefore, the present invention provides the novel combination of: i) a glass-melting furnace having a melting end and a fining end through which molten glass freely flows in an unimpeded manner so as to be blended and discharged from the furnace; ii) an exhaust disposed within a downstream fining end of the furnace; and, iii) the exhaust disposed for allowing exhaust gases to provide additional heat to the melting glass-forming material. It is

submitted that the present inventive furnace is configured to allow at least some air-entrained glass-forming materials (carried in the exhaust gases) to settle back into the melting glass as exhaust gases travel from the upstream end to the downstream end.

Accordingly, for at least these reasons, Applicants submit that the claims are patentable under 35 U.S.C. §102(b).

B. Whether claims 2, 10-11 and 18 are also patentable under 35 U.S.C. §103(a).

Claims 2, 10, 11 and 18 stand rejected as being obvious over the Shepherd reference, in view of the Pflügl reference.

To establish prima facie obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka,* 490 F.2d 981, 180 USPQ 580 (CCPA 1974). That is to say, the references, when combined, must teach or suggest all the claim limitations. *In re Vaeck,* 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). The claimed invention must be considered as a whole and the references must be considered as a whole. *Hodosh v. Block Drug Co., Inc.*, 786 F.2d 1136, 1143 n.5, 229 USPQ 182 187 n.5 (Fed. Cir. 1986). Also, when applying 35 U.S.C. § 103, the cited references must be considered as a whole, must suggest the desirability and thus the obviousness of making the combination, and must be viewed without the benefit of impermissible hindsight vision afforded by the claimed invention. *Hodosh v. Block Drug Co., Inc.*, supra.

Further, if an independent claim is allowable, then any claim depending therefrom is allowable. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988).

Claims 2, and 10-11 depend from independent claim 1, and claim 18 depends from independent claim 15. Thus, these dependent claims are allowable over Shepherd for at least the reasons set forth above.

At least another reason these claims are further patentably distinct over the Shepherd and the Pflügl references is that the Pflügl reference describes an *incinerator* for refuse where slag is melted and heavy metals are separated using three different chambers within the melt furnace. In the Pflügl reference, gases are exhausted out of all three chambers. (See, for example, in Fig. 1 in the Pflügl reference, arrow 15, arrow 26 and arrow 39). The Pflügl reference thus fails to address the need to prevent the "exhaust from being removed only at the downstream end of the furnace", which problem is solved by the present invention.

There is no reason to reconfigure the Shepherd *upstream exhaust* furnace with

elements from the Pflügl *refuse incinerator* furnace in order to make the inventive *glass-melting* furnace. The present inventive glass melting furnace includes at least one exhaust that is positioned downstream in order to allow an increased residence time of exhaust gases in the furnace. In the present invention, the positioning of the downstream exhaust provides a more efficient use of what had been "waste" heat in prior art glass-melting furnaces. Thus, in the present inventive glass-melting furnace, the exhaust is positioned to: i) allow exhaust gases to provide additional heat to the melting glass-forming material, and ii) allow at least some air-entrained glass-forming materials to settle back into the melting glass as exhaust gases travel from the upstream end to the downstream end.

Further, claims 2, 10-11 and 18 recite embodiments having at least two exhaust stacks which are positioned or located at the downstream end of the furnace. The Shepherd reference fails to disclose at least two exhaust *downstream* stacks. The Pflügl reference also fails to teach or disclose at least two exhaust stacks which are positioned at the downstream end of the furnace. Instead, the Shepherd and Pflügl references disclose exhaust ports positioned at the upstream end of a furnace.

In the absence of such teaching, the Examiner had failed to establish a prima facie case of obviousness. Accordingly, claims 7, 10-11 and 18 should be allowable over the Shepherd and Pflügl references in their own right.

Accordingly, for at least these reasons, claims 7, 10-11 and 18 should be allowable over the Shepherd and Pflügl references in their own right.

C. Whether claims 9 and 14 are also patentable under 35 U.S.C. §103(a).

Claims 9 and 14 stand rejected over the Shepherd reference, in view of the Hoke reference. Claims 9 and 14 depend from claims 1 and 15, respectively, and should be allowable over Shepherd for at least the reasons set forth above.

If an independent claim is allowable, then any claim depending therefrom is allowable. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988).

At least another reason these claims are further patentably distinct over the Shepherd and the Hoke references is that the Hoke reference fails to cure the deficiencies in the Shepherd reference. The Examiner had admitted that Shepherd does not disclose an exhaust that is located at a sidewall of the furnace. For this teaching, the Examiner relied on Hoke, asserting that Hoke discloses a glass melting furnace where exhausts are located at sidewalls

of the furnace. However, claim 14 recites two exhausts, wherein each exhaust is separated laterally from the sidewalls.

There is also no interrelated teaching between the Shepherd and Hoke references, nor is there any "apparent reason" to combine the elements of Hoke and Shepherd. The common-sense creative person skilled in the art would not look to the Shepherd and Hoke references to provide two downstream exhausts, each separated laterally from the sidewalls, as set forth in claim 14.

In the absence of such teaching or suggestion, claim 14 should be allowable over the Shepherd and Hoke references in its own right for at least the reasons set forth herein.

D. Whether Claims 34-37 are also patentable under 35 U.S.C. §103(a).

Claims 34-37 stand rejected over the Shepherd reference, in view of the Simpson or LeBlanc references. Claims 34-37 depend from claim 1 and should be allowable over Shepherd for at least the reasons set forth above.

If an independent claim is allowable, then any claim depending therefrom is allowable. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988).

In particular, the claims 34-37 provide additional structurally unique features to the claimed invention. Claim 34 recites a fining zone within the glass-melting furnace and at least one downstream burner supplying heat to the fining zone. Claim 35 recites that the downstream burner is mounted in the roof. Claim 36 recites that at least one upstream burner is mounted at an angle of up to about 20 degrees to the vertical. Claim 37 recites that the downstream burner is mounted at an angle of up to about 20 degrees to the vertical.

At least another reason these claims are further patentably distinct is that the Simpson and LeBlanc references fail to cure the deficiencies in the Shepherd reference. The Examiner had admitted that Shepherd does not disclose a burner for supplying heat to the downstream fining end. For this teaching, the Examiner had relied on Simpson and/or Leblanc, asserting that Simpson and/or Leblanc disclose a glass melting furnace where a burner is installed in the roof.

There can be no interrelated teaching between the Shepherd, Simpson and LeBlanc references, nor is there any "apparent reason" to combine the Shepherd *upstream exhaust* elements with the Simpson and/or Leblanc furnaces. The common-sense creative person skilled in the art would not look to use either the Simpson or LeBlanc reference to provide

upstream and downstream burners in combination with an exhaust positioned at the downstream end of at least one burner. Neither the Simpson nor the LeBlanc reference teaches or suggests a furnace where the exhaust is in communication with the downstream end of the furnace so that combustion gases in the glass-melting furnace are exhausted only from the exhaust at the downstream end of the glass-melting furnace.

In the absence of such teaching or suggestion, claims 34 - 37 should be allowable over the Shepherd, Simpson and LeBlanc references in their own right for at least the reasons set forth herein.

Conclusion

In view of the above remarks, Appellants have shown that the claims are in proper form for allowance, and the invention, as defined in the claims herein, is neither disclosed nor suggested by the references of record. In view of the foregoing arguments, the rejections of claims 1-18, 27-32 and 34-37 are in error, and should be reversed. Appellants accordingly respectfully request that the Board of Patent Appeals and Interferences reverse the Examiner as to all rejections.

VIII. Claims Appendix

1. A glass-melting furnace comprising:

an elongated channel consisting of a charge end wall, a discharge end wall, two side walls, a floor, and a roof, the elongated channel defining an upstream melting end, a downstream fining end through which molten glass is discharged, the upstream end being positioned upstream of the downstream end in the glass-melting furnace;

a charger supplying glass-forming material to the upstream end of the glass-melting furnace;

at least one burner supplying at least a majority of the heat to the glass-forming material at the upstream end of the glass-melting furnace;

the upstream end and the downstream end being configured to allow unimpeded flowing and blending of the glass-forming material; and

an exhaust disposed within the downstream end of the glass-melting furnace for exhausting combustion gases only from the downstream end of the glass-melting furnace, the exhaust further being positioned downstream of the at least one burner;

the exhaust disposed for allowing exhaust gases to provide additional heat to the melting glass-forming material, and for allowing at least some air-entrained glass-forming materials to settle back into the melting glass as exhaust gases travel from the upstream end to the downstream end.

2. The glass-melting furnace of claim 1 in which the at least one burner is mounted through the roof of the glass-melting furnace.

3. The glass-melting furnace of claim 1 in which the at least one burner is a plurality of burners.

4. The glass-melting furnace of claim 3 in which more than 50 percent of the burners are positioned upstream of the exhaust.

5. The glass-melting furnace of claim 4 in which all of the burners are positioned upstream of the exhaust.

6. The glass-melting furnace of claim 1 in which the exhaust is an exhaust stack.

7. The glass-melting furnace of claim 1 in which the exhaust is a plurality of exhaust stacks.

8. The glass-melting furnace of claim 1 in which the exhaust is disposed at a discharge end wall of the glass-melting furnace.

9. The glass-melting furnace of claim 1 in which the exhaust is disposed at a sidewall of the glass-melting furnace.

10. The glass-melting furnace of claim 1 in which the at least one burner is a plurality of burners mounted through the roof of the glass-melting furnace, all of the burners are positioned upstream of the exhaust outlets, and the exhaust comprises at least two exhaust outlets.

11. The glass-melting furnace of claim 10 in which the exhaust outlets are a plurality of exhaust stacks.

12. A glass-melting furnace comprising:

an elongated channel consisting of a charge end wall, a discharge end wall, two side walls, a floor, and a roof, the elongated channel defining an upstream melting end and a downstream fining end through which molten glass is discharged, the upstream end being positioned upstream of the downstream end in the glass-melting furnace;

the upstream end and the downstream end being configured to allow unimpeded flowing and blending of melting glass-forming material;

an exhaust disposed within with the glass-melting furnace, the exhaust having a centerline that is positioned at least about 70 percent of the distance from the charge end wall of the glass-melting furnace to the discharge end wall of the glass-melting furnace for exhausting combustion gases in the glass-melting furnace;

the exhaust disposed for allowing exhaust gases to provide additional heat to the melting glass-forming material, and for allowing at least some air-entrained glass-forming materials to settle back into the melting glass as exhaust gases travel from the upstream end to the downstream end.

13. The glass-melting furnace of claim 11 in which the exhaust centerline is positioned at least about 80 percent of the distance from the charge end wall of the glass-melting furnace to the discharge end wall of the glass-melting furnace.

14. The glass-melting furnace of claim 12 wherein the glass-melting furnace comprises two sidewalls and two exhausts, each exhaust being separated laterally from the sidewalls.

15. In a glass-melting furnace having an elongated channel consisting of a charge end wall, a discharge end wall, two side walls, a floor, and a roof, the elongated channel defining an upstream melting end and a downstream fining end through which molted glass is discharged, the upstream end being positioned upstream of the downstream end, the improvement comprising:

the upstream melting end and the downstream fining end being configured to allow unimpeded flowing and blending of melting glass-forming material;

an exhaust disposed within the glass-melting furnace at the downstream end of the glass-melting furnace for exhausting combustion gases in the glass-melting furnace only from the downstream end;

the exhaust disposed for allowing exhaust gases to provide additional heat to the melting glass-forming material, and for allowing at least some air-entrained glass-forming materials to settle back into the melting glass as exhaust gases travel from the upstream end to the downstream end.

16. The glass-melting furnace of claim 15 wherein the exhaust is disposed at the discharge end wall.

17. The glass-melting furnace of claim 15 wherein the exhaust comprises an exhaust stack.

18. The glass-melting furnace of claim 15 wherein the exhaust comprises a plurality of exhaust stacks.

27. A glass-melting furnace comprising:

an elongated channel consisting of a charge end wall, a discharge end wall, two side walls, a floor, and a roof, the elongated channel defining an upstream melting end and a downstream fining end through which molten glass is discharged;

a charger supplying glass-forming material to the upstream end of the glass-melting furnace;

the upstream end and the downstream end being configured to allow unimpeded flowing and blending of melting glass-forming material; and

at least one exhaust at the downstream end of the glass-melting furnace for exhausting combustion gases only from the at least one exhaust;

the exhaust being disposed to i) allow exhaust gases to provide additional heat to the melting glass-forming material, and ii) allow at least some air-entrained glass-forming materials to settle back into the melting glass as exhaust gases travel from the upstream end to the downstream end.

28. The glass-melting furnace of claim 27 in which the at least one exhaust has a centerline that is positioned at least about 70 percent of the distance from the upstream end to the downstream end of the glass-melting furnace.

29. A glass-melting furnace comprising:

an elongated channel consisting of a charge end wall, a discharge end wall, two side walls, a floor, and a roof, the elongated channel defining an upstream melting end and a downstream fining end through which molten glass is discharged;

a charger supplying glass-forming material to the upstream end of the glass-melting furnace;

the upstream end and the downstream end being configured to allow unimpeded flowing and blending of melting glass-forming material;

at least one burner supplying heat to the glass-forming material at the upstream end of the glass-melting furnace; and

one or more exhausts disposed only at the downstream end of the glass-melting furnace for exhausting combustion gases in the furnace only from the downstream end of the glass-melting furnace;

the exhaust disposed for allowing: i) exhaust gases to provide additional heat to the melting glass-forming material, and ii) at least some air-entrained glass-forming materials to settle back into the melting glass as exhaust gases travel from the upstream end to the downstream end.

30. The glass-melting furnace of claim 29 in which the one or more exhausts have centerlines that are positioned at least about 70 percent of the distance from the upstream end to the downstream end of the glass-melting furnace.

31. A glass-melting furnace comprising:

an elongated channel consisting of a charge end wall, a discharge end wall, two side walls, a floor, and a roof, the elongated channel defining a melting zone first half, and a fining zone second half through which molten glass is discharged;

a charger supplying glass-forming material to a charge end of the first half of the glass-melting furnace;

the upstream end and the downstream end being configured to allow unimpeded flowing and blending of melting glass-forming material;

at least one burner supplying heat to the glass-forming material in the first half of the glass-melting furnace; and

at least one exhaust disposed within the second half of the glass-melting furnace and no exhaust disposed within the first half of the glass-melting furnace for exhausting combustion gases only from the second half of the glass-melting furnace;

the exhaust disposed for allowing: i) exhaust gases to provide additional heat to the melting glass-forming material, and ii) at least some air-entrained glass-forming materials to

settle back into the melting glass as exhaust gases travel from the upstream end to the downstream end.

32. The glass-melting furnace of claim 31 wherein the first half defines a charge end and the second half defines a discharge end, the at least one exhaust having a centerline that is positioned at least about 70 percent of the distance from the upstream end to the downstream end of the glass-melting furnace.

34. The glass-melting furnace of claim 1 further comprising at least one downstream burner supplying heat to the downstream fining end.

35. The glass-melting furnace of claim 34 in which the downstream burner is mounted in the roof.

36. The glass-melting furnace of claim 35 in which at least one upstream burner is mounted at an angle of up to about 20 degrees to the vertical.

37. The glass-melting furnace of claim 36 in which the downstream burner is mounted at an angle of up to about 20 degrees to the vertical.

IX. Evidence Appendix

None.

X. Related Proceedings Appendix

None.